

REMARKS

Please reconsider the present application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering the present application.

I. Disposition of Claims

Claims 1-17 are currently pending in the present application. By way of this reply, claims 1, 3, 8, 9, 11, and 17 have been amended.

II. Claim Amendments

Claim 1 has been amended to recite that the heat removal device is physically secured to a second portion of the mounting surface by an attachment means that is formed of a material different than a material of the heat removal device. Further, claim 1 has been amended to recite that a height of the attachment means extends from the second portion to past a height of the semiconductor die. No new matter has been added by way of these amendments as support for these amendments may be found, for example, in Figure 7 of the present application.

Claim 3 has been amended to be consistent with the amendments made to claim 1 discussed above. No new matter has been added by way of this amendment.

Claim 8 has been amended to correct a minor punctuation error. No new matter has been added by way of this amendment.

Claim 9 has been amended to recite that the method of claim 9 comprises in part disposing an attachment means to physically secure a heat removal device to a second

portion of the mounting surface. Further, claim 9 has been amended to recite that a height of the disposed attachment means extends from the second portion to past a height of the disposed semiconductor die. No new matter has been added by way of these amendments as support for these amendments may be found, for example, in Figure 7 of the present application.

Claim 11 has been amended to be consistent with the amendments made to claim 9 discussed above. No new matter has been added by way of this amendment.

Claim 17 has been amended to recite that a height of the attaching means extends from the supporting means to past a height of the semiconductor die. No new matter has been added by way of this amendment as support for this amendment may be found, for example, in Figure 7 of the present application.

III. Rejection(s) Under 35 U.S.C § 102

Claims 1-7 of the present application were rejected under 35 U.S.C. § 102(b) as being anticipated by Sherif et al. (hereinafter "Sherif"). For the reasons set forth below, this rejection is respectfully traversed.

The present invention is generally directed to a solid flip-chip assembly. With reference to the exemplary embodiment of the present invention shown in Figure 7 of the present application, a flip-chip assembly in accordance with the present invention has (i) a package substrate 13, (ii) a semiconductor die 11 mounted on a portion of the package substrate 13, (iii) a heat removal device 27 physically secured to the package substrate 13 by an attachment means 41, and (iv) a thermal interface layer 39 disposed between the semiconductor die 11 and the heat removal device 27.

Further, still with reference to Figure 7 of the present application, as recited in amended independent claims 1, 9, and 17 of the present application, the attachment/attaching means **41** has a height that extends from a portion of the package substrate **13** to *past* a height of the semiconductor die **11**. Such a flip-chip assembly configuration at least allows for the use of (1) a heat removal device relatively larger than the semiconductor device so as to provide increased heat dissipation and (2) a secure and structure that maintains a connection between the package substrate and the heat removal device without placing excessive force on the semiconductor die.

Sherif, in contrast to the present invention, fails to disclose all the limitations of amended independent claims 1, 9, and 17 of the present application. Sherif, as shown in Figures 1-4 of Sherif, discloses the use of a purported attachment means **28** that is used to seal off any leaks existing upon placement of a cap/cover **25** over a plurality of chips (*e.g.*, **20** in Figures 2 and 3 of Sherif) so as to prevent irrecoverable module yield losses. *See* Sherif, column 6, lines 28 – 42. This purported attachment means **28** is not used to provide structural integrity of the connection between the cap/cover **25** and the substrate **10**. Due to the purpose of the purported attachment means **28** disclosed in Sherif, Sherif does not contemplate or disclose an attachment means having a height that extends from a portion of the substrate to *past* a height of the semiconductor die as required by amended independent claims 1, 9, and 17 of the present application.

One of ordinary skill in that art will recognize that the height of the purported attachment means **28** disclosed on Sherif is especially narrow because the aim in Sherif is to house the plurality of chips (*e.g.*, **20** in Figures 2 and 3 of Sherif) as completely as possible with one cap/cover piece **25**. The use of multiple pieces to house the plurality of

chips (*e.g.*, **20** in Figures 2 and 3 of Sherif) would increase the likelihood of the presence of leaks (due to an increased amount of interfaces between the pieces), an effect which Sherif particularly seeks to avoid. *See* Sherif, column 6, lines 35 – 39. In Sherif, because the cap/cover **25** cannot be integrated with the substrate **10**, a small adhesive or solder layer **28** is used to seal the connection of the cap/cover **25** to the substrate **10** so as to house the plurality of chips (*e.g.*, **20** in Figures 2 and 3 of Sherif) as completely as possible. *See* Sherif, column 6, lines 41 – 43. As evident in Figures 1-4, the purported attachment means **28** has a height that extends from a portion of the substrate **10** to a height greatly below the bottom of the semiconductor die (*e.g.*, **20** in Figures 2 and 3 of Sherif). Thus, Sherif clearly fails to disclose an attachment/attaching means having a height that extends from a portion of a package substrate to *past* a height of a semiconductor die mounted on the package substrate as required by amended independent claim 1 of the present application. Similarly, Sherif also fails to disclose the corresponding method and means-plus function limitations in respective amended independent claims 9 and 17 of the present application.


In view of the above, Sheri fails to show or suggest the present invention as recited in amended independent claims 1, 9, and 17 of the present application. Thus, amended independent claims 1, 9, and 17 of the present application are patentable over Sheri. Dependent claims are allowable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

IV. Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 03226.111001;P6259).

Respectfully submitted,

Date: 1/16/04


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